

**Final Outbrief
of the Representation
of the
Individual Combatant
Workshop**

Conducted July 1-2, 1996

Topics of Discussion

- Introduction
- Purpose of Conference/Attendees
- Terms of Reference for Modeling the Individual Combatant
- Assessing the State of the Art for Modeling IC
 - Physical Battle Environment
 - Combatant State
 - Dynamic Behavioral Response
- Issues Facing the Individual Combatant Simulation Community
- Recommendations

Introduction

This outbrief represents the initial impressions and thoughts of select members of the DMSO staff following attendance at the Individual Combatant Workshop on July 1-2, 1996 in Alexandria, VA. The workshop was the second of three to be hosted by DMSO as part of developing a roadmap to achieve the objectives and subobjectives for HBR outlined in the Master Plan.

The outbrief should be used as a point of departure for considering the current state of the art of modeling e individual combatant, as perceived by successful practitioners and other attendees.

Purpose of Conference

- The purpose of the workshop is to allow current practitioners to discuss their on-going efforts in the representation of the individual combatant, and to afford the broader community the opportunity to interact and generate a technical exchange of ideas, information, and lessons learned. In so doing, it is envisioned that the community's knowledge of the current state of the practice (technology issues and approaches/methodology) of representing more authoritative individual behavior in modeling across the DoD will be enhanced.

Terms of Reference for Modeling the Individual Combatant

- Simulation Requirements
- Representation of the effects of the following:
 - physical battle environment
 - mission
 - soldier state
 - dynamic behavioral response
- Design/Architecture
- Other Issues

General Impressions

- Several efforts are underway to simulate the individual combatant (IC). These efforts fall into the following two areas:
 - Simulation of IC to support the analysis/ development of new systems (IUSS, STRADIS, Soldier Station)
 - Simulation of IC to augment SAF in training (SAF-DI, TTES, STOW-97)
- Simulated battle environments for IC are generally highly polygonalized terrain/individual buildings. Little work in environmental phenomenology.

General Impressions (cont'd)

- Cognitive capabilities of IC are generally represented either by simple rule based techniques or full human-in-the-loop (HITL) participation. Cognitive stimuli limited primarily to geometric considerations of terrain and proximity to simulated enemy.
- Scenario applications focus on elementary MOUT operations, (building clearing) and small unit maneuver. No OOTW or peacekeeping missions.
- VV&A of IC systems has been difficult, leading primarily to “face validation” by SMEs.

Assessing State of the Art for Modeling Individual Combatant

Physical Battle Environment

The physical battle environment provides a context for conducting IC operations. Parameters in this environment include:

- terrain resolution/features - natural atmospheric conditions
- dynamic terrain changes - man-made obscurants
- Current applications depend on highly polygonalized terrain/building features to govern basic IC functions (movement, detection, cover, engagement).
- Significant trade-offs are made between levels of terrain resolution necessary to simulate IC activities and the graphic hardware's ability to render a real-time scene.

Assessing State of the Art for Modeling Individual Combatant

Physical Battle Environment (cont'd)

- IC representations utilize high resolution data (12.5m to 0.3m posting) hence limited databases exist (Range 400, McKenna). Topographical/feature databases for these areas are quite detailed.
- Only advanced applications (STOW-97) are attempting to represent atmospheric phenomenology.
- With the exception of dust as a sensory cue in STOW, no applications allow the IC to realistically respond to masked targets where location cues are provided by sound, smell, tactile, and other sensory effects.

Assessing State of the Art for Modeling Individual Combatant

Mission

The mission provides a context within which the IC's task and goal oriented behavior are defined. Parameters defining mission tasks representation include:

- type of military operation
(maneuver, MOUT, OOTW)
- command level represented
- mission support represented
(IC casualty support/evaluation)
- mission order structure
evaluation)
- Current IC applications represent maneuver and engagement of mounted/other dismounted forces. Representation of basic maneuver tactics (fire and move, covering fire, etc.) is stabilizing and maturing.

Assessing State of the Art for Modeling Individual Combatant

Mission (cont'd)

- With the exception of IUSS which was a de novo attempt to model individuals as individuals, IC simulations have evolved from two fundamental architectures: higher level units (squads) to individual combatants; and from platform based simulations. It is difficult to represent SOF, OOTW, and other non-maneuver activities in unit based simulations. (We are adapting rather than creating).
- General mission tasks, i.e., “cover objective with fire” are transmitted explicitly in advanced IC simulations. Sub-tasks, i.e., tactics for IC, are implied in rule bases.

Assessing State of the Art for Modeling Individual Combatant

Mission (cont'd)

- Some limited, productive efforts for a conceptual model of the mission space (CMMS) for Army IC have been completed, but a comprehensive IC-CMMS across all services is needed.

Assessing State of the Art for Modeling Individual Combatant

Soldier State

The soldier's physiological and psychological state represents the personal environment from which they must perform their battle tasks. Parameters reflecting these states include:

Physiological

- injury status/degradation, heat stress, fatigue, fear

Psychological

- cognitive (friendly, situational, environmental, or enemy awareness)

- Representation of activity degradation for heat stress, sickness and fatigue are available in some IC simulations. Effects of suppression, fear, motivation and injury are not well represented.

Assessing State of the Art for Modeling Individual Combatant

Soldier State (cont'd)

- A well documented body of data exists relating wound severity to the geometries of body position/round impact. These could be used to better define effects of injury in IC simulations.
- IC cognitive understanding of the battle situation is over-represented. Combatants tend to have perfect knowledge of their surroundings/friendly battle status, and even enemy situation/intent. IC is rarely lost or stressed in strange terrain or buildings.

Assessing State of the Art for Modeling Individual Combatant

Dynamic Behavioral Response

The reaction of the IC to both the physical battle environment and the perceived state of his combat unit represents a behavioral response. The response can be either reactive (considering only the current situation), or proactive (projecting current actions into future states) in nature. Some parameters for consideration governing response include:

- trigger stimuli
- cognitive reasoning
- communication techniques
- C2 techniques of other ICs
- Command and control representations are limited to templating geometries for positioning with rule bases driving tactical behaviors

Assessing State of the Art for Modeling Individual Combatant

Dynamic Behavior Response (cont'd)

- Stimuli triggering behaviors are limited to “geometric based” discovery of enemy/obstacles in most IC representations. Triggering by other perceptual cues (sounds, smells, tactile, and secondary signatures (i.e., dust)) is almost nonexistent.
- The primary technique for decision making/reasoning is rule based systems. These rule based structures also specify/drive behaviors in most IC simulations.
- Communication techniques are focused on message passing. Non-message communication (gestures, hand signals, body language, etc.) are in an embryonic state.

Issues Facing the Individual Combatant Simulation Community

- Environment being represented is not the environment humans operate in
 - representation of environment still being done primitively
 - emphasis is on visual; no sound, tactile or other sensory cues
 - visual cues from terrain and buildings, but not from other ICs, or from secondary signatures such as dust
- Soldier state
 - situational awareness is not modeled
 - response based, not cognitive based

Issues Facing the Individual Combatant Simulation Community

(cont'd)

- Data
 - many databases exist that are not widely known, nor easily accessed
 - data on methodology and/or process needed
- Use of simple rule-based systems to exclusion of other approaches
- What technology needs to be developed, or what different methodologies need to be utilized to obviate the need for human-in-the-loop (HITL) when doing so would pay dividends (i.e., analytic applications)